System Specification

Data Health Completion Thread, Thor DP1

Checkout and Launch Control System (CLCS)

84K00302-004

Data Health Completion Thread

Assessment

March 17, 1998

1.   Introduction

1.1   Data Health Completion Thread Overview.

The Thor Data Health Completion Thread provides the completion of the CLCS capability to provide health information for FDs. This Thread will support Data Health processing, viewing, logging and retrieval.
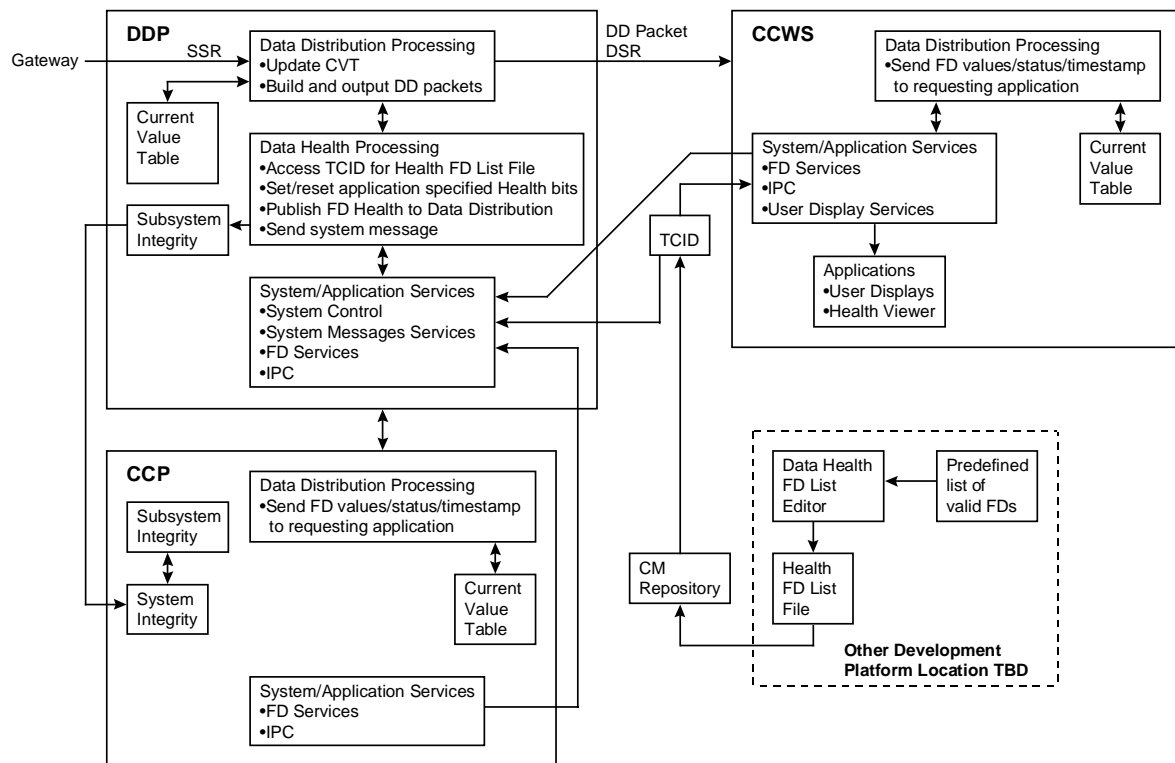
1.2   Data Health Completion Thread Concept

Data Health is the term applied to the integrity and validity of a Function Designator (FD) value which is being distributed from a CLCS subsystem. The health of an FD may represent the state of a hardware component, a communication path, resultant data from a Fusion operation, or application data. The status of the FD health is represented by two bits, a failure bit and a warning bit. When the failure bit is set, it indicates that the system has determined that the data is invalid, and the value should be ignored. When the warning bit is set, it indicates that the validity of the FD is questionable, and that an operator or engineer decision or analysis of more related data may be needed.
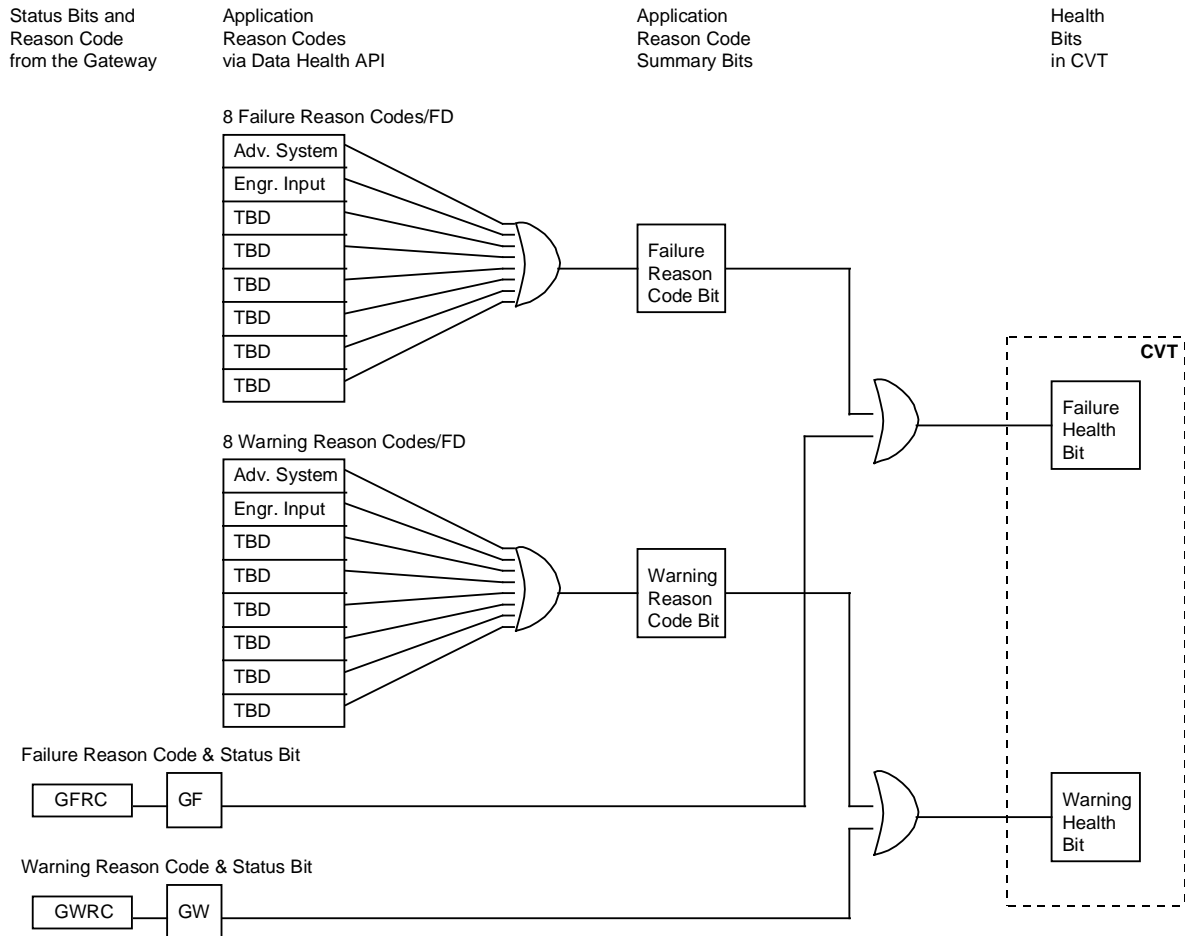
For the Redstone Delivery, the health of an FD was determined and applied at the gateways, passed on to the DDP, and distributed to the CCWSs (formerly known as the HCIs) by the Data Distribution CSC.   The capability for an application to set and reset the health status of FDs via an application program interface was also provided.

For the Thor Delivery, the Data Health Completion Thread will focus on the following:
- Data Health API updates
- Application Services API for Data Health support
- System Integrity support
- Record and retrieval of FD health data via the SDC
- Performance tuning
- Interface with external systems

Data Health Thread Concept Diagram

DDP

Gateway → SSR →

Data Distribution Processing
•Update CVT
•Build and output DD packets

Current
Value
Table

Data Health Processing
•Access TCID for Health FD List File
•Set/reset application specified Health bits
•Publish FD Health to Data Distribution
•Send system message

Subsystem
Integrity

System/Application Services
•System Control
•System Messages Services
•FD Services
•IPC

DD Packet
DSR →

CCWS

Data Distribution Processing
•Send FD values/status/timestamp
to requesting application

System/Application Services
•FD Services
•IPC
•User Display Services

Current
Value
Table

Applications
•User Displays
•Health Viewer

TCID

CCP

Subsystem
Integrity

System
Integrity

Data Distribution Processing
•Send FD values/status/timestamp
to requesting application

Current
Value
Table

System/Application Services
•FD Services
•IPC

CM
Repository

Data Health
FD List
Editor

Predefined
list of
valid FDs

Health
FD List
File

**Other Development
Platform Location TBD**

2

Version 2.0   Basic

Data Health Status Bits Concept Diagram

Status Bits and   Application   Application   Health
Reason Code   Reason Codes   Reason Code   Bits
from the Gateway   via Data Health API   Summary Bits   in CVT

8 Failure Reason Codes/FD

| Adv. System |
| Engr. Input |
| TBD |
| TBD |
| TBD |
| TBD |
| TBD |
| TBD |

Failure Reason Code Bit

8 Warning Reason Codes/FD

| Adv. System |
| Engr. Input |
| TBD |
| TBD |
| TBD |
| TBD |
| TBD |
| TBD |

Warning Reason Code Bit

Failure Reason Code & Status Bit

| GFRC | GF |

Warning Reason Code & Status Bit

| GWRC | GW |

CVT

Failure Health Bit

Warning Health Bit

1.3   Data Health Completion Thread Specification

1.3.1   Statement Of Work

- Provide record and retrieval capability.
- Provide demonstration of a Ground Support Equipment Analog health value.
- Provide performance data for system modeling.
- Provide interfaces for End item Manager, Test Application Scripts, CCWS applications, and other applications to provide reason code(s) ~~and associated system messages~~ to Data Health.
- Provide the capability for the Data Health function to be utilized in both Operational and ~~Test Bed~~ application development configurations.
- Provide logging of error, performance and state change information.
- Baseline system messages using the System Message Catalog to include message and help text.
- Define and provide the Initial System Viewer capability for FD Health. The viewer will, for all health bits, display any reason information ~~including data path algorithms~~ with input and internal values. The viewer will allow updates at a TBD request rate.   (Carried over from Redstone)
- Define and provide the Initial Pre-build ~~Data Path Health~~ Data Health FD list Editor.   (Carried over from Redstone)
- Provide the capability to build Data Health Tables in the Test Build process. (Carried over from Redstsone)
- Provide a solution for users to define reason codes and their associated text. (New)

1.3.2   Requirements

Performance Requirements from SLS

SLS 2.2.2.1.15   The Data Health Function shall support the "system maximum data bandwidth".

Other Data Health Related SLS Requirements

SLS 2.2.5.2.1   The RTPS shall automatically track and maintain the health of all Measurement FDs.

SLS 2.2.5.2.2   Data Health information shall be updated any time the health changes.

SLS 2.2.5.2.3   The RTPS shall provide health information to all users and system or user applications of measurement information.

SLS 2.2.5.2.4   Users and system and user application shall have the capability to view health and status information on individual and groups of measurements.

SLS 2.2.5.2.5   The RTPS shall provide the capability to set and reset health and status.

SLS 2.2.5.2.6   The RTPS measurement FD Health function shall be fault tolerant.

SLS 2.2.5.2.7   RTPS Measurement FD Health shall include the known information about processing within CLCS including Gateway FD processing and redundancy management.

SLS 2.2.5.2.8   RTPS Measurement FD Health shall include the capability for manual input by engineering personnel.

SLS 2.2.5.2.9   CLCS shall provide the capability for users to define Data Path Health algorithms to be utilized by the RTPS Measurement FD Health function.

SLS 2.2.5.2.10   RTPS Measurement FD Health shall include the capability to interface with external systems to obtain data that assists in computing Data Path Health.

SLS 2.2.5.2.11   RTPS Measurement FD Health shall include the capability for User Advisory Expert System applications to provide Health Warning Indications.

SLS 2.2.5.2.12   CLCS shall provide the capability for Measurement Health to be persistent between different tests.

SLS 2.2.5.2.13   CLCS shall provide the user with the capability to selectively choose which Measurement FD Health is to be persistent.

1.4   Data Health Completion Thread Hardware Diagram

Not Applicable.

1.5   Data Health Completion Thread Deliverables

Deliverable	R&D Document	Code	API Manual	Users Guide
Data Distribution & Processing CSCI - Data Health CSC	Yes	Yes	Yes	N/A
Application Services CSCI	Yes	Yes	Yes	N/A
System Integrity CSCI	Yes	Yes	Yes	Yes
System Message Catalog	Yes	Yes	Yes	Yes
System (Data Health) Viewer CSCI	Yes	Yes	N/A	Yes
SDC	Yes	Yes	TBD	TBD

1.6   Data Health Completion Thread Assessment Summary

This section contains the summary of the costs and labor involved in implementing the Data Health Completion Thread capabilities. It is broken into three sections. The first is a summary of the individual CI (CSCI and HWCI) labor assessments. The second is a summary of hardware costs. The third is a summary of procurement activities needed.

1.6.1   Labor Assessments

The total Labor Costs required to provide this capability are summarized in the following table:

No.	CSCI/HWCI Name	Thor LM	Changes covered in
1	Data Distribution Processing CSCI - Data Health CSC	15.0 LM	Data Health Completion Thread
2	Application Services CSCI	6.0 LM	Data Health Completion Thread
3	System Integrity	0	Covered by the System Integrity Thread
4	System Message Catalog	0	Covered by the System Viewer Thread
5	Data Health Viewer	0	Covered by the System Viewer Thread
7	SDC	TBD	TBD
	TOTAL	21.0 LM	

1.6.2   Hardware Costs

None.

1.6.3   Data Health Completion Thread Procurement

None.

1.7

Data Health Completion Thread Schedule & Dependencies

1.7.1 Schedule

Task Name	Start	Finish
Thor Assessment Kickoff	07/23/97	07/23/97
Concept Panel Internal Review	09/10/97	09/10/97
Concept Panel	09/12/97	09/12/97
Thor Development		
Requirement Panel Internal Review	09/30/97	09/30/97
Requirement Panel	10/02/97	10/02/97
Design Panel Internal Review	10/28/97	10/28/97
Design Panel	10/30/97	10/30/97
CSCI Unit Testing (UT)	01/02/98	01/09/98
CSCI Development Integration Test (UIT)	01/12/98	01/23/98
CSCI Formal Integration Test (CIT)	01/26/98	01/30/98
Support System Integration Test	02/23/98	03/27/98
Thor Development Complete	03/27/98	03/27/98

1.7.2 Dependencies

The following dependencies are essential to the UIT and CIT schedule listed above:

No.	Dependency Area	Dependency	Need Date
1	Data Distribution CSC	Needed for Unit testing. • Capability to reset Data health bits based on application/Data Health provided reason code.	01/02/98
2	Application Services	Needed for CIT. • Provide API for End Item Managers, Test Application Scripts, and other application to provide reason code to Data Health and to obtain reason code and health bits from Data Health (i.e. a wrapper around the Data Health API).	1/12/98
3	Message Catalog Services	Needed for users to define the Data Health reason code and associated message text, to be used by the Data Health Viewer and SDC: • Capability for the users to define reason code and associated message text (with insert capability), via a System Message like Web interface, to be stored in the Data Health Reason code repository (which could be the same as the System Message catalog). • API to retrieve the reason code and associated message text in real time.	01/02/98 TBD
4	Data Health Viewer CSC	Needed for CIT. • Capability to display the Data Health status of FDs, along with the reason code and the associated message text.	1/12/98
5	SDC	Needed for CIT. • Capability to record Data Health change packets. • Capability for user/application to be able to retrieve Data Health information, on an FD basis, along with the associated message text and data value for the FD.	1/12/98
6	SDE-JSC	Target Network available at SDE-JSC facility.	12/15/97

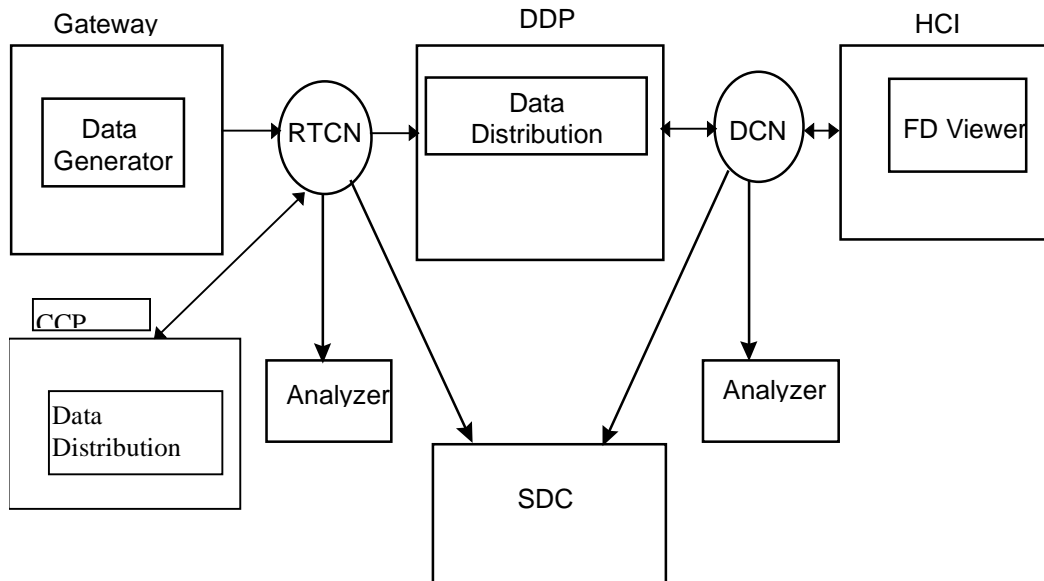## 1.8 Data Health Completion Thread Simulation Requirements

Test tools will be provided by the Data Health CSC to set the reason code for FDs for simulation purposes.

1.9 Data Health Completion Thread Integration and System Test

Data Health Completion Thread end-to-end development testing will be performed prior to start of System Test:

- The Data Generator or a real gateway will be used to send FD data values and status.
- The Data Distribution CSC will be receiving, processing and distributing the FD status.
- The Data Health CSC will test the DH API, based on requests generated by a Data Health test tool.
- The Data Health reason code retrieval API will be used by the Data Health Viewer and the SDC for retrieval of reason and associated message text.
- The Data Health viewers will be used to display FD health bits, reason code and associated message text.
- An Application Services provided test tool (emulating an End Item Manager, Test Application Script, and any application) will be used to test the FD Services API (to demonstrate that an application will be able to set/reset FD reason code, and query FD reason code with the associated message text).
- System Messages will be used for debug and verification purposes.
- The SDC recording and retrieving capability will be used to verify that changed health data packets are recorded at the SDC, and that a user/application will have the capability to retrieve the data value and the associated health status via an SDC interface.

System test plan and test procedures will be prepared by the System Test Organization.

1.10 Data Health Completion Thread Training Requirements

None.

1.10.1 Training Needed

None.

1.10.2 Training to be provided

Hands-on training on using the Data Health Test Tool and the FD list Editor will be provided upon request.

1.11   Data Health Completion Thread Facilities Requirements

The Data Health Completion Thread facility requirements for SDE-JSC are covered by the Data Distribution Completion Thread facility requirements.

1.12   Travel Requirements

This section contains a list of travel requirements. If there are none, the section should state none.

From	To	Reason	No. People	Duration	Est. Date or Frequency
Houston	KSC	Support of Design Panels by Houston developers	1	3 days	3 trips
Houston	KSC	On-site integration testing and system testing by Houston developers	1	1 week	2 trips
Houston	KSC	On-site training developer	1	1 week	1 trip

1.13   Data Health Completion Thread Action Items/Resolution

1. When an application assigns a Data Health reason code to an FD, an authentication check is required to verify that the application has the authority to do so. The Data Health CSC will provide the capability to assign any reason code to an FD upon request, but the authentication check and the reason code validity check will be done in the FD Services layer. The mechanism of how this is accomplished needs to be addressed.

2. The SDC retrieval requirements for Data Health needs to be understood. Since the Data packets for health status and data value for the same FD may be sent as separate packets, the mechanism of correlating the data value and data health status for the same FD during SDC retrieval time needs to be addressed.

3. Data Health persistency was discussed at the internal DP1. Outcome of the discussion was, data persistency is not just a Data Health issue, and will be addressed in the Atlas.

4. The usage of System Message Catalog for Health reason code was flagged as an issue at the internal DP1.
Resolution: The issue was raised due to the wording used in the Dependency section, which is no longer an issue after the wording is changed. Current wording indicates that a Web interface will be provided for the users to define the Data Health reason code and the associated message text, and that the reason code information will be stored in a Data Health reason code repository, which could be the same as the System Message repository.

2.   CSCI Assessments

2.1   Data Distribution & Processing CSCI Assessment

The following capabilities will be provided by the Data Distribution CSCI in support of the Data Distribution Thread:

Data Health CSC Name 1 Work Required

The Data Health CSC will be enhanced to support the following:

Data Health API Updates
- Update the existing application program interface for an application to reset the failure reason code and the warning reason code, which will result in the resetting of the associated Health bit.
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System Integrity Support
- Notify Subsystem Integrity immediately whenever a failure occurs that causes Data Health (ddh_control) to cease processing of Data Health requests.
- Provide an application program interface (API) that allows Subsystem Integrity to obtain the following information:
  - Overall health of Data Health.
  - Error situations (e.g. Failure to connect to Data Distribution).

Data Path Health Support to External Systems
- Define the format of a file to be used by External Systems to pass Data Path Information to the Data Health function.
- Provide the capability to parse the file and set the health reason code accordingly, via the use of the Data Health API.

FD List Definition Editor
- Provide an X-Motif GUI that allows users to:
  - Select FDs from a scrollable list (using a specified file as a base) to generate a list of FDs
  - Select the FD that represents the list ID
  - Provide a list of lists capability (might need list hierarchy specification)
  - Generate a Health FD list file in a format recognized by the Data Health API
  - Allow the user to specify the name of the output file

Test Build FD Validation Utility
Provide a Test Build FD validation utility to verify that every FD in the Data Health Tables exists in a specified file (TCID, or any user specified TCID file). This utility is intended for but not limited to be used for the Test Build.

Data Health Reason Code Definition
- Work with the Message Catalog CSC and users to define Data Health reason code naming convention, range assignment to subsystems, hierarchy, etc.

Performance Tuning
- If needed, optimize the code to meet the SLS performance requirement.
- Tune the system for better performance result.

Test Tools
- Provide test tools for diagnostic and testing purposes in a single box environment
  - The capability to use the Data Health API to :
    - Set and reset reason code for an FD or list of FDs.
    - Retrieve reason code for an FD or list of FDs.
    - Retrieve Data Health bits for an FD or list of FDs.

Application Development Support
- Ensure that Data Health will be able to run in a "CLCS in a box" type of application development environment.

System Message Enhancement
- Provide help information for each Data Health System Message
- Integrate help information into System Message catalog

System Test Support
- Provide developer support for generation of System Test Procedures, hands-on training, and problem isolation during System Test.

CSCI Assessment

CSC Name	CSC Labor (LM)	% of CSC

Data Health CSC
■ API Updates
■ Data Path Health Support to
   External Systems
■ Performance Tuning
■ System Integrity Support
■ Test Tools
■ FD List Definition Editor
■ FD Validation Utility
■ Application Development
   Environment Support
■ DH System Message Enhancement
■ System Test Support
	2.0 LM
	
	3.0 LM
	1.0 LM
	
	1.5 LM
	1.0 LM
	1.5 LM
	2.0 LM
	1.0 LM
	
	1.0 LM
	1.0 LM	

TOTAL	**15.0 LM**	

Basis of estimate

Estimate is based on a combination of the following:
- Source lines of code - code additions will be interspersed among existing code, which means any addition will require some amount of analysis to ensure that the addition is compatible with and not impacting the existing software.
- Complexity factor.
- Amount of integration testing needed.

Documentation

Document Type	New/Update	Number of Pages
Requirements and Design Documentation	Update	10
Users Guide	N/A	N/A
API Interface Document	Update	3
Interface Design Document	N/A	N/A
Test Procedure	Update	20

Assumptions

Refer to the Data Health Completion Thread Action Items and Resolution Section (Section 1.13).

Open Issues

Refer to the Data Health Completion Thread Action Items/Resolution items in Section 1.13.

2.2   Application Services CSCI Assessment - To Be Provided

Applications Services (ASV) provides the thin layer between Data Health and user applications. ASV provides APIs to read health data via the FD object, and to set health data related to an FD object.

Function Designator and User Display Services Required:

- Provide new FD type of LIST FD.
- Provide access to FD List flat file.
- Provide APIs to set health reason code. When this API executes, the user is authenticated (via Command) to ensure that the user is privileged to set health. APIs include setting the health of a single FD, and a list of FDs (via a special list FD type).
- Provide an API to translate a health reason code into its associated text. [Relies on a TCID supplied flat file.] In the event that there is no associated text, a message indicting the lack of text will be returned.
- Provide APIs (or access to data) including:
    - Was the last value change or refresh data?
    - Is processing active or inhibited for this FD?
    - Is the data path associated with this FD active or inhibited?
    - Is the applications advisory notification active or inhibited for this FD?
    - Is engineering by-pass active or inhibited for this FD?
    - Is the data stale indicator on for this FD?   [These requirements are from the Pete Simon's API document]
- Provide special APIs as required for Health Viewer.

Applications Services Assessment

CSC Name	CSC Labor	% of CSC
FD Services	4	
User Display Services	2	
Total	6	

Basis of estimate

Estimate is based on Redstone experience.

Documentation

Document Type	New/Update	Number of Pages
Requirements and Design Documentation	Update	30
Users Guide	N/A	
API Interface Document	15	
Interface Design Document	N/A	
Test Procedure	New cases	40

Other:

Assumptions

Open Issues

Assessment Provided By: Julia Samson, ASV CSCI Lead, 1-2212

2.3   System Viewer CSCI Assessment

The Data Health Viewer will be able to display FD Data Health Status, associated reason code and message text.

CSCI Assessment

The cost assessment for this CSCI will be covered in the System Viewer Thread.

2.4   System Message CSCI Assessment

The System Message Catalog CSC will provide the capability for users to define FD health reason code and associated message text, and have the definitions stored in a repository.

CSCI Assessment

The cost asessment for this CSCI will be covered in the System Message Thread.

2.5   SDC CSCI Assessment - To Be Provided

The SDC will provide the following capability:
- Recording of Data Health change packets on the RTCN and DCN.
- An interface that will allow users/applications to retrieve FD health information (including health bits, reason code, and associated message text), along with the corresponding FD data value, on an FD basis.

CSCI Assessment

TBD

3.   HWCI Assessments

Not Applicable.